Second Hand Marijuana Smoke: What do we know?

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Longmont, Colorado Couple: Second Hand Pot Smoke is Endangering Baby

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Active and Passive Chemical Exposure from MJ: An Emerging Issue

- Combustion of plant material will result in a complex chemical mixture in smoke
- Although tobacco smoking is decreasing, MJ use may be increasing
- Tobacco smoke chemistry has been well characterized: 4000 chemicals, >50 carcinogens (Hoffman et al. 2001)
- 1992 EPA report “Respiratory Health Effects of Passive [Tobacco] Smoking: Lung Cancer and Other Disorders”
- Few investigations characterizing MJ smoke; qualitative investigations suggest MJ has similar carcinogens as tobacco smoke.

Mainstream and Sidestream smoke, Tobacco vs. Marijuana (Moir et al. 2008)

- MJ smoke contains many of the same chemicals as tobacco smoke
- Some chemicals were 3-5x higher in MJ smoke: NO, NOx, HCN, and aromatic amines; Ammonia 20x higher in MJ smoke
- PAHs, Formaldehyde, and Acetaldehyde moderately higher in mainstream Tobacco smoke.
- In sidestream smoke, higher levels of a number of PAHs in MJ smoke were measured.
- Note: levels may vary with sample and smoking conditions

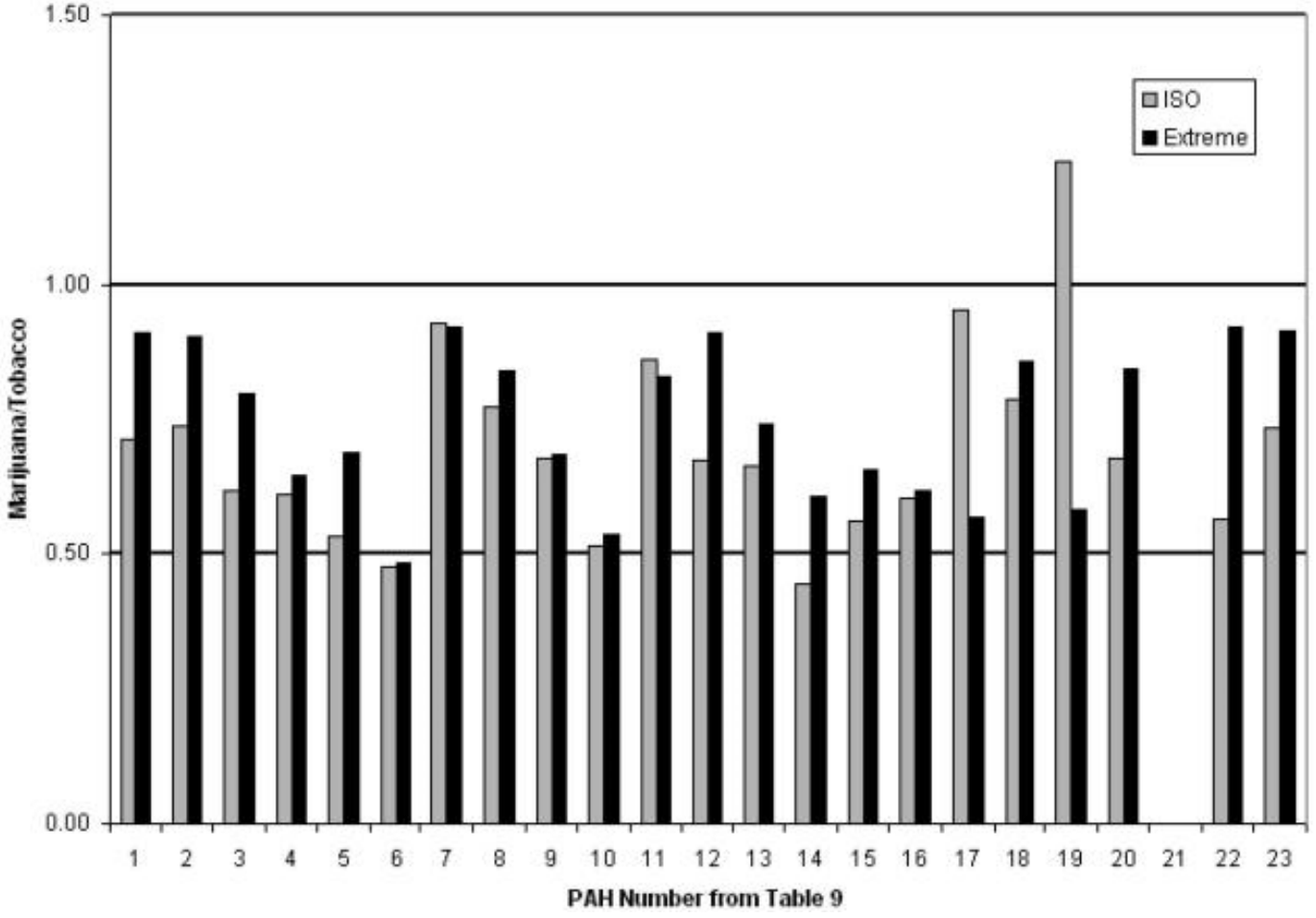
Various Analytes Including Tobacco-Specific Compounds and Heavy Metals Determined in Mainstream Smoke from Tobacco and Marijuana under Two Smoking Conditions[a]

	ISO		extreme	
	tobacco	marijuana	tobacco	marijuana
tar (mg/cig)	38.2 ± 2.2	37.4 ± 4.5	80.3 ± 5.6	103 ± 11*
pH	5.5 ± 0.05	7.21 ± 0.17*	5.47 ± 0.04	7.73 ± 0.10*
NO (μg/cig)	65.7 ± 8.9	296 ± 33*	151 ± 10	685 ± 58*
NOx (μg/cig)	68.2 ± 9.2	302 ± 33*	158 ± 10	693 ± 58*
CO (mg/cig)	20.8 ± 1.9	13.4 ± 1.6*	41.5 ± 4	35.3 ± 2.9*
nicotine (mg/cig)	2.44 ± 0.18	0.005 ± 0.011*	5.2 ± 0.39	0.002−0.007*
ammonia (μg/cig)	35.5 ± 2.4	720 ± 84*	67 ± 9.9	1315 ± 106*
HCN (μg/cig)	208 ± 24	526 ± 46*	320 ± 29	1668 ± 159*
NNN	87.6 ± 4.4	<1.49*	160 ± 15	<1.49*
NAT	71 ± 3.4	<1.87*	125 ± 9	<1.87*
NAB	5.68 ± 0.42	<0.063*	8.26 ± 0.47	0.063−2.00*
NNK	86.7 ± 5.2	<3.72*	158 ± 15	<3.72*
mercury	3.17 ± 0.32	<1.10*	5.35 ± 0.52	3.51 ± 0.31*
cadmium	145 ± 8	6.91 ± 1.34*	284 ± 7	14.6 ± 1.2*
lead	21.1 ± 1.1	3.85−12.8*	43.8 ± 2.9	7.7−25.7*
chromium	5.94−19.8	5.94−19.8	11.9−39.6	11.9−39.6
nickel	6.47−21.6	6.47−21.6	12.9−43.1	<12.9
arsenic	5.49 ± 0.33	1.13−3.75*	12.7 ± 0.9	2.25−7.49*
selenium	2.21−7.37	2.21−7.37	4.42−14.7	4.42−14.7

[a] Values are provided ± standard deviations. For tar, nicotine, and CO, $n = 20$. For all others, $n = 7$. Units are ng/cigarette unless noted differently. *$P < 0.05$ vs tobacco. Values shown with "<" were below the limit of detection; values shown as a range were above the limit of detection but below the limit of quantitation.

MJ:Tobacco Ratios of PAHs in Mainstream Smoke Under Two Smoking Conditions (Moir et al. 2008)

no.	
1	naphthalene
2	1-methylnaphthalene
3	2-methylnaphthalene
4	acenaphthylene
5	acenaphthene
6	fluorene
7	phenanthrene
8	anthracene
9	fluoranthene
10	pyrene
11	benzo(a)anthracene
12	chrysene
13	benzo(b)fluoranthene
14	benzo(k)fluoranthene
15	benzo(e)pyrene
16	benzo(a)pyrene
17	perylene
18	indeno(1,2,3,-cd)pyren
19	dibenz(a,h)anthracene
20	benzo(g,h,i)perylene
21	5-methylchrysene
22	benzo(b)fluoranthene
23	benzo(j)fluoranthene



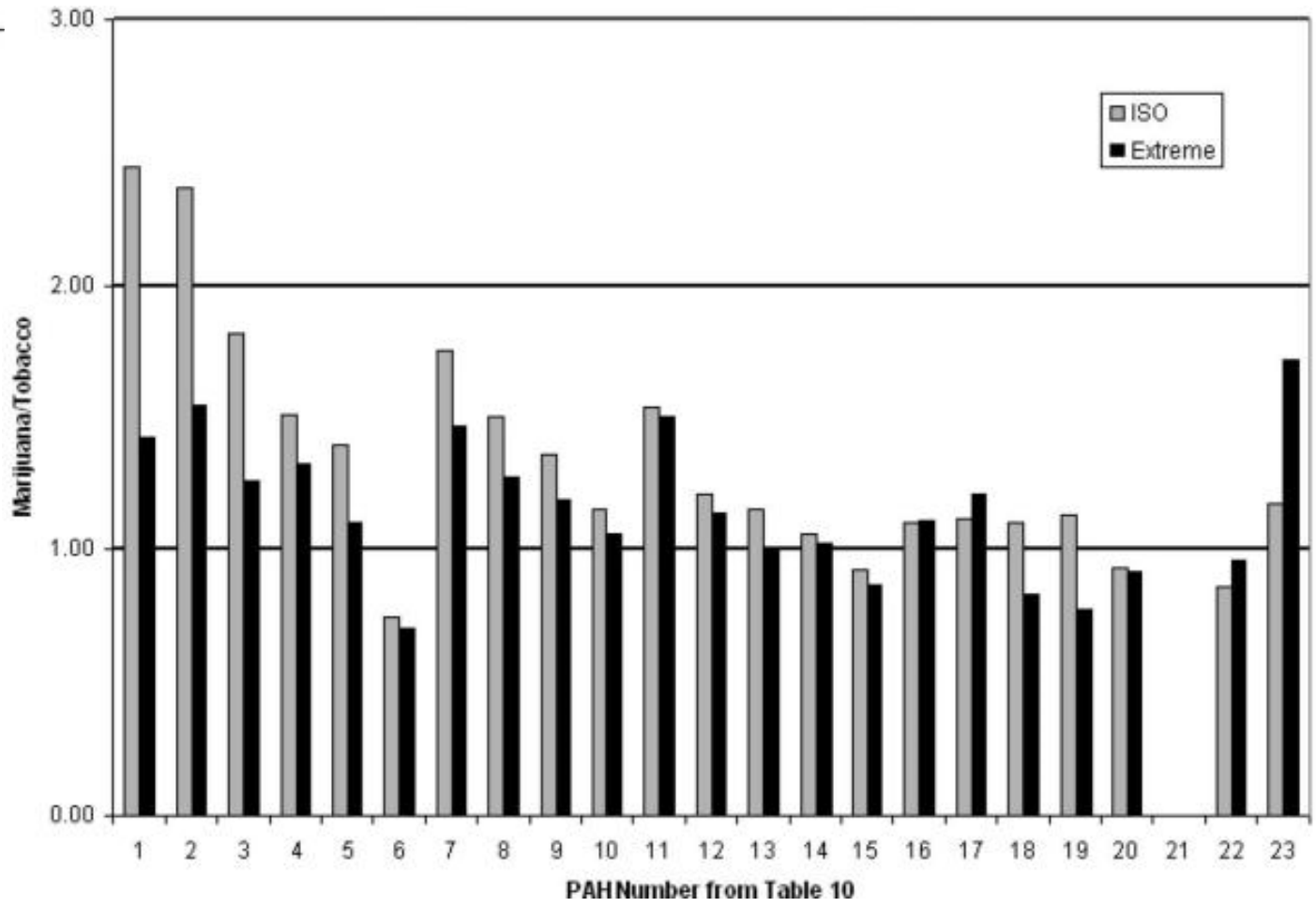
ISO: 35/2/60

Extreme: 70/2/30

Volume puff in ml/ Duration puff in seconds/ Interval between puffs in seconds

MJ:Tobacco Ratios of PAHs in Sidestream Smoke Under Two Smoking Conditions (Moir et al. 2008)

no.	
1	naphthalene
2	1-methylnaphthalene
3	2-methylnaphthalene
4	acenaphthylene
5	acenaphthene
6	fluorene
7	phenanthrene
8	anthracene
9	fluoranthene
10	pyrene
11	benzo(a)anthracene
12	chrysene
13	benzo(b)fluoranthene
14	benzo(k)fluoranthene
15	benzo(e)pyrene
16	benzo(a)pyrene
17	perylene
18	indeno(1,2,3,-cd)pyrene
19	dibenz(a,h)anthracene
20	benzo(g,h,i)perylene
21	5-methylchrysene
22	benzo(b)fluoranthene
23	benzo(j)fluoranthene



ISO: 35/2/60
Extreme: 70/2/30
Volume puff in ml/ Duration puff in seconds/ Interval between puffs in seconds

Passive Exposure to THC?

- Combustion of cannabis, tetrahydrocannabinol-acid precursors converted to delta-9-tetrahydrocannabinal (THC)
- 50% THC survives pyrolysis, a portion delivered to smoker, a lesser but significant amount is released into air
- Passive exposure dependent on
  - Duration
  - THC content of marijuana
  - Amount of marijuana smoked
  - Environmental conditions

SHS THC Exposure Studies

- Passive inhalation could result in absorption of sufficient amounts of THC to produce low, but detectable levels of THC in blood and urine (Perez-Reyes et al 1983; Mason et al 1983; Morland et al. 1985)
- Intense MJ smoke exposure, passive inhalers report behavioral effects similar to those when they actively smoked marijuana (Cone and Johnson, 1986)
- Significant amounts of THC were absorbed by subjects at a high level (16 “joints” 2.8% TCH) of passive smoke exposure, resulting in urinary excretion of cannabinoid metabolites (Cone et al. 1987)

In Summary

- MJ smoke contains many of the same cytotoxic, mutagenic, and carcinogenic components of tobacco smoke
- Levels of chemicals may vary among strain and cultivation techniques
- Causal links between MJ smoke and disease including lung cancer have not been established
- High levels of THC in smoke can result in passive exposure
- With 2-7x higher THC concentrations in modern cannabis, THC concentrations in SHS may be higher than reported in previous studies.